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POSSIBLE LEARNED DETECTION OF EXOGENOUS BRAIN FREQUENCY ELECTROMAGNETIC FIELDS: A CASE STUDY

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Summary.—Zener card representations were presented visually for 15 sec. every 30 sec. for a total of 40 trials per session over 17 sessions to a single subject who displayed temporal lobe lability. During the 15 sec. before the presentation of one of the symbols (target) either a specific 4-Hz magnetic field pattern or a 1-Hz or 7-Hz magnetic field was presented bilaterally at the level of the temporal lobes. Field strengths were in the order of milligauss (about 1000X background values). The subject was required to anticipate the next symbol for each trial. Only when the 4-Hz field preceded the target symbol did the subject's accuracy of guessing remain systematically above (50%) chance (20%) over the sessions. These results suggest that exogenous magnetic fields may become discriminative stimuli through temporal association. Evidence of habituation was also obtained.

The possibility that exogenous brain-frequency electromagnetic fields are subject to associative conditioning has been suggested from animal studies (Persinger, 1974). Persinger (1979) hypothesized that environmental magnetic fields might become discriminative stimuli or cues that herald the consequent occurrence of more evident perceptual stimuli. Such an association between specific external biofrequency magnetic fields and later environmental events might explain some types of precognitive experiences. This association would be likely if the person was already prone to temporal lobe lability (Persinger, 1983). To test this hypothesis, one 20-yr.-old female volunteer (BM) who had a *T*-score of over 70 on the temporal lobe-sign inventory (Persinger & Makarec, 1987) and who had a long history of spontaneous psi experiences, was given 17 conditioning sessions (about twice a week) over a 10-wk. period.

This subject was fitted with a modified motorcycle helmet within which were embedded (bilaterally) 5 pairs of small soft iron solenoids (2 cm in length). A 3.5-cm length soft iron nail with a cross-sectional width of 0.16 cm was placed within each solenoid so that the remaining length formed a "pole." The small solenoids (actually reed relay induction coils; 250 Ω) were arranged in a plus pattern such that both the vertical and horizontal arrangements shared the same center solenoid.[3] In the horizontal arrangement the solenoids were spaced every 4 cm (total of 8 cm) along the temporal plane roughly at the level of the midtemporal lobes. In the vertical arrangement, the solenoids were separated by 1.5 cm (5 cm) and were arranged along the level of the dorsal to ventral width of the temporal lobes midway between their rostral-caudal boundaries.

Current to the solenoids was supplied by a Heath Schlumberger function generator that was controlled by a microcomputer. On the basis of the subject's responses during a baseline training period, a 4-Hz sine-wave field distributed along the caudal portion

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of the solenoid matrix was used as the cue or discriminative stimulus. When this field pattern was activated, a 4-Hz field was generated simultaneously at two pairs of solenoids. The control fields were either a 1-Hz or 7-Hz sine wave field which were selected since we reasoned that these frequencies would be at the ends of the distribution of the preferred microseizure firing. The field was presented in random spatial configurations (so that no systematic association would develop) around the matrix with each control session. The strength of the field between a pair of magnets within 1 cm of the nearest solenoid inside of the helmet was 180 mgauss and 5 mgauss at 4 cm within the helmet (approximate depth of hippocampus) for the 4-Hz field. These values for the 1-Hz field were 30 mgauss and 1 mgauss, respectively; they were 300 mgauss and 8 mgauss for the 7-Hz field. The field strength gradient for the 4-Hz field was 20%/cm in the rostral-caudal plane. Field strength at the eyes approached background (250 microgauss). The measurements were completed by a Model 113 Power Frequency Field Meter (Denometer; POB 326, Rt 183 W. Stockbridge, MA, 01266; 413-637-1929).

The subject sat in a comfortable chair and faced a 1-m × 1-m screen. On her lap was a device that contained five buttons each of which was designated by one of the Zener cards (circle, wavy line, star, square, and plus) symbols. Serial order of symbols for a given session was determined by selecting the 35-mm slides blindly from a large pile of slides. The same computer that controlled the solenoids also controlled (after programming for target) a slide projector; it presented one of these symbols on 35-mm slides for 15 sec. every 30 sec. During the nonslide (15-sec.) blank, she anticipated the next symbol by pushing one of the buttons. The symbol (reinforcement) was then presented; her mean latency of responding was about 10 sec.; consequently, her response (guess) occurred about 5 sec. before the actual stimulus was presented.

If the blank period were preceded by a star (target symbol), then the 4-Hz magnetic field was presented during conditioning days; if the blank period did not precede a star, then no field was presented. On nonconditioning days, either the 1-Hz or 7-Hz fields were presented during the blank period before each star stimulus. The total single presentation of either the conditioning or control fields was 30 sec. (15 sec. during blank period; 15 sec. during symbol presentation). Each session consisted of 40 trials during which there were between four and eight star stimuli presented.

As can be seen in Fig. 1, those sessions in which the target symbol was preceded by

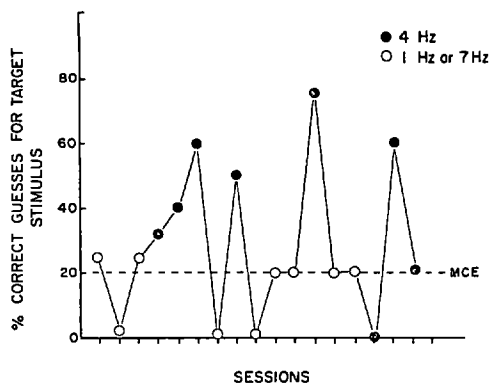

FIG. 1. Percent correct guesses for the target stimulus during conditioning (●) and control (○) sessions. During the 15-sec. guess period before the presentation of a target stimulus on conditioning sessions the subject was exposed to 4-Hz magnetic fields (discriminative stimulus) within the milligauss range. During control sessions, the subject was exposed to either 1-Hz or 7-Hz fields of similar magnitudes. The 4-Hz fields were systematically presented over the posterior portion of the temporal lobes while the other fields were randomly presented within a configuration of solenoids along the temporal plane. MCE refers to mean chance expectancy.

the 4-Hz fields were associated with greater accuracy of guessing the target symbol than for those days when the control fields were used. An acquisition-like profile occurred during the earlier sessions (4 to 6). Despite intermittent presentation of the 4-Hz fields during the next few sessions, the conditioning remained robust. However, the effect was less evident during the latter part of the learning sessions.

These results suggest that this subject was detecting weak 4-Hz fields and using them as cues for consequent guessing of the target stimulus. Although she reported no artifactual experiences (such as a buzz) during any particular phase of the experiment, her accurate responses (concomitant with the 4-Hz fields) were associated often with a feeling of "being correct"; "images" of the consequent target stimulus were sometimes reported. It should be emphasized that the fields would have been quite diffuse by the time they reached the temporal cortex and certainly by the time they penetrated into subcortical areas. Technology that allows focused concentration (<1 cm^2) of magnetic fields within the deep temporal lobe structures is required before experimental simulation of temporal lobe symptoms can be explored systematically.

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